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Imaging Actinides at the APS: Current and Future Possibilities

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Most specimens and materials of interest, either manmade or natural, are complex and heterogeneous, typically in three dimensions. X-ray imaging and microscopy are unique tools that permit not only visualization of specimen structure at high spatial resolution, but also, because of their significant depth penetration, the acquisition of depth information through the use of tomographic approaches. Full-field techniques typically excel in speed of data acquisition and direct visualization of specimen structure, down to the level of several tens of nanometers. Scanning probe methods tend to be slower, but they can provide richer information, including chemical sensitivity down to trace levels, and offer the ability to probe local elemental oxidation states, as well as probe reciprocal space information through microdiffraction.

We will give an overview of imaging techniques available at the APS and report on their use in several relevant applications, ranging from the visualization of trace amounts of Pu in mammalian cells to the characterization of oxide layers formed on Zr alloys. We will also provide an outlook on future instrumentation.